

Appendix D

Indirect Exposure Methodology and Inputs

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Table D-1. Vapor-phase air concentration from soil emissions (mg/m³)

C_{vapor}

$$C_{vapor} = \frac{C_{soil}}{VF}$$

Name	Description	Value
VF	Volatilization factor for unlimited mass (m ³ /kg)	Calculated
Csoil	Soil concentration (mg/kg)	Set equal to waste concentration

Based on Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, EPA, 2001, OSWER 9355.4-24.

Table D-2. Volatilization factor for unlimited mass - Commercial/Industrial Scenario (m³/kg)

<i>VF</i>

$$VF = \frac{\left(QC \times (3.14 \times D_{app} \times T) \right)^{\frac{1}{2}} \times 0.0001}{[2 \times BD \times D_{app}]}$$

Name	Description	Value
0.0001	Conversion factor (m ² /cm ²)	
T	Exposure interval (s) (9.5E+08 sec or 30 years)	
D _{app}	Apparent diffusivity (cm ² /s)	Calculated
QC	Dispersion Factor (g/m ² -s)/(kg/m ³)	Calculated
BD	Dry soil bulk density (g/cm ³)	See Appendix H

Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, EPA, 2001, OSWER 9355.4-24, equation 4-8.

Table D-3. Dispersion Factor (g/m²-s)/(kg/m³)

Q/C

$$QC = DF_A \times e^{\left\{ \frac{(\ln(Area) - DF_B)^2}{DF_C} \right\}}$$

Name	Description	Value
Area	Source Area (acres)	See Appendix H
DF_A	Constant selected based on location (unitless)	See Appendix H
DF_B	Constant selected based on location (unitless)	See Appendix H
DF_C	Constant selected based on location (unitless)	See Appendix H

Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, EPA, 2001, OSWER 9355.4-24.

Table D-4. Apparent diffusivity (cm²/s)

<i>D_{app}</i>

$$n = 1 - \left(\frac{BD}{\rho S} \right)$$

$$\theta_v = n - \theta_w$$

$$D_{app} = \frac{\left(\theta_v \left(\frac{10}{3} \right) \times D_a \times H_{prime} + \theta_w \left(\frac{10}{3} \right) \times D_w \right)}{\left(\frac{2}{n} \right)} \div \left(BD \times Kd_{soil} + \theta_w \times \theta_v \times H_{prime} \right)$$

$$Kd_{soil} = Koc \times foc$$

$$H_{prime} = HLC_{coef} \times HLC$$

$$HLCcoef = \frac{1}{(R \times Temp)}$$

Name	Description	Value
RhoS	Solids particle density (g/cm ³)	
HLCcoef	Coefficient to Henry's law constant (unitless)	Calculated
Hprime	Dimensionless Henry's law constant (unitless)	Calculated
KdSoil	Soil-water Partition Coefficient (mL/g)	Calculated
n	Total soil porosity (L pore/L soil)	Calculated
Theta_v	Dry soil void fraction OR air filled soil porosity (L air/L soil)	Calculated
Da	Diffusivity in air (cm ² /s)	See Appendix E
Dw	Diffusivity in water (cm ² /s)	See Appendix E
Koc	Organic carbon partition coefficient (mL/g)	See Appendix E
BD	Soil bulk density (g/cm ³)	See Appendix H
foc	Fraction organic carbon in soil (unitless)	See Appendix H
Theta_w	soil volumetric water content OR water-filled soil porosity (L water/L soil)	See Appendix H

Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, EPA, 2001, OSWER 9355.4-24, equation 4-8.

Table D-5. Washout ratio for vapor-phase contaminants (unitless)

W_v

$$W_v = R \times \frac{T_{air}}{HLC}$$

Name	Description	Value
R	Ideal Gas Constant (atm-m ³ /K-mole) (0.00008206)	Constant
HLC	Henry's Law Constant (atm m ³ /mole)	See Appendix E
T _{air}	Ambient temperature (K)	See Appendix H

MPE, 1998 eq(6-18).

Table D-6. Annual wet deposition from vapors (g/m²-yr)

<i>Dyw</i>

$$Dyw = C_{\text{vapor}} \times May \times W_v \times 0.00001$$

Name	Description	Value
1.00E-05	Conversion factor (10 ⁻³ g/mg)(10 ⁻² m/cm)	
Cvapor	Contaminant air concentration from vapors (mg/m ³)	Calculated
W _v	Volumetric washout ratio from vapors (unitless)	Calculated
May	Average annual moisture (precipitation: rainfall, snowfall) (cm/yr)	See Appendix H

MPE, 1998 eq(4-3 for particles and 6-16 for vapors)

Table D-7. Annual dry deposition from vapors (g/m²-yr)

<i>Dyd</i>

$$D_{yd} = 315.36 \times V_{dv} \times C_{\text{vapor}}$$

Name	Description	Value
315.36	Conversion factor ([3.1536E+07 sec/yr]/[100 cm/m][1e3 mg/g])	
Cvapor	Vapor phase air concentration (mg/m ³)	Calculated
Vdv	Dry deposition velocity of vapors (cm/s)	See Appendix E

MPE, 1998 eq(4-2 for particles and 6-17 for vapors)

Table D-8. Total Concentration in Above-Ground Vegetation (mg/kg - WW or DW)

<i>Pveg</i>

$$Pveg_{WW} = \frac{(Pd + Pv + Pr) \times (100 - MAF)}{100}$$

Name	Description	Value
Pr	Above-ground vegetation concentration due to root uptake (mg/kg - DW)	Calculated
Pv	Vegetative concentration due to air-to-plant transfer (mg/kg - DW)	Calculated
MAF	Plant tissue-specific moisture adjustment factor to convert DW concentration into WW (percent)	See note below
Pd	Vegetative concentration due to direct deposition (mg/kg - DW)	Set to 0 (based on particles only)

Source: U.S. EPA, 1998.

Note: For exposed vegetation MAF is 92, for exposed fruit MAF is 85, and for protected fruit MAF is 90. Dry weight is used for silage and feed. Wet weight is used for exposed vegetataion, exposed fruit, and protected fruit

Table D-9. Above-ground vegetation concentration due to root uptake (mg/kg - DW)

<i>Pr</i>

$$Pr = C_{soil} \times Br$$

Name	Description	Value
BrExfruit	Soil-to-plant bioconcentration factor for exposed fruit (mg/kg DW plant / mg/kg soil)	See Appendix E
BrExveg	Soil-to-plant bioconcentration factor for exposed vegetables (mg/kg DW plant / mg/kg soil)	See Appendix E
BrForage	Soil-to-plant bioconcentration factor for forage (mg/kg DW plant / mg/kg soil)	See Appendix E
BrGrain	Soil-to-plant bioconcentration factor for grain (mg/kg DW plant / mg/kg soil)	See Appendix E
BrProfruit	Soil-to-plant bioconcentration factor for protected fruit (mg/kg DW plant / mg/kg soil)	See Appendix E
BrSilage	Soil-to-plant bioconcentration factor for silage (mg/kg DW plant / mg/kg soil)	See Appendix E
Csoil	Concentration of contaminant in soil (mg/kg)	Set equal to waste concentration

Source: U.S. EPA, 1998.

Table D-10. Vegetative Concentration Due to Air-to-Plant Transfer (mg/kg - DW)

P_v

$$P_v = D_v \times R_p \times \frac{(1 - e^{(-K_p V_{ap} \times T_p)})}{(Y_p \times K_p V_{ap})}$$

Name	Description	Value
Dv	Deposition term for plants (for vapor) (mg/m ² -yr)	Calculated
KpVap	Plant surface loss coefficient, vapor (1/yr)	See Appendix E
LogKow	Octanol-water partition coefficient (unitless)	See Appendix E
Rp_exfruit	Interception fraction for exposed fruit (unitless)	See Appendix F
Rp_exveg	Interception fraction for exposed vegetables (unitless)	See Appendix F
Rp_forage	Interception fraction for forage (unitless)	See Appendix F
Rp_silage	Interception fraction for silage (unitless)	See Appendix F
Tp_exfruit	Length of plant exposure to deposition for exposed fruit (yr)	See Appendix F
Tp_exveg	Length of plant exposure to deposition for exposed vegetables (yr)	See Appendix F
Tp_forage	Length of plant exposure to deposition for forage (yr)	See Appendix F
Tp_silage	Length of plant exposure to deposition for silage (yr)	See Appendix F
Yp_exfruit	Crop yield for exposed fruit (kg DW/m ²)	See Appendix F
Yp_exveg	Crop yield for exposed vegetables (kg DW/m ²)	See Appendix F
Yp_forage	Crop yield for forage (kg DW/m ²)	See Appendix F
Yp_silage	Crop yield for silage (kg DW/m ²)	See Appendix F

Source: U.S. EPA, 1998.

Table D-11. Concentration in Below-Ground Vegetation Due to Root Uptake
(mg/kg - WW)

<i>Prbg</i>

$$Prbg = C_{soil} \times RCF \times \frac{VGbg}{Kd_{soil}}$$

$$Kd_{soil} = Koc \times foc$$

Name	Description	Value
Kdsoil	Soil-water partition coefficient (mL/g) or (L/kg)	Calculated
Koc	Organic carbon partition coefficient (mL/g)	See Appendix E
RCF	Root concentration factor (mg/kg - WW plant) / (mg/L soil water)	See Appendix E
VGbg	Empirical correction factor for below ground vegetables (unitless)	See Appendix F
foc	Fraction organic carbon in soil (unitless)	See Appendix H
Csoil	Concentration of contaminant in soil (mg/kg)	Set equal to waste concentration

Source: U.S. EPA, 1998.

Table D-12. Vapor Term for Plants (mg/m²-yr)

<i>D_v</i>

$$D_v = 1000 \times F_v \times (D_{yd} + (F_w \times D_{yw}))$$

Name	Description	Value
1000	Conversion factor (mg/g)	
D _{yd}	Normalized annual dry deposition from vapor phase (s-m ² /m ² -yr)	Calculated
D _{yw}	Normalized annual average wet deposition from vapor phase (s-m ² /m ² -yr)	Calculated
F _v	Fraction of air concentration in vapor phase (unitless)	See Appendix E
F _w	Fraction of wet deposition adhering to plant surface (unitless)	See Appendix E

Table D-13. Concentration in Beef Due to Plant and Soil Ingestion (mg/kg - WW)

<i>A_{beef}</i>

$$PlantIntake = (F_{-grain} \times Q_{gbs} \times Pr_{-grain}) + (F_{-forage} \times Q_{fbs} \times Pr_{-forage}) + (F_{-silage} \times Q_{sbs} \times Pr_{-silage})$$

$$A_{beef} = ((PlantIntake + (Q_{soilbs} \times C_{soil}) + (C_{water} \times Q_{wbs})) \times Ba_{Beef})$$

Name	Description	Value
PlantIntake	Amount of vegetation consumed by beef cattle (mg/day) (mg/day)	Calculated
Pr_forage	Vegetative concentration for forage (mg/kg - DW)	Calculated
Pr_grain	Vegetative concentration for grain (mg/kg - DW)	Calculated
Pr_silage	Vegetative concentration in silage (mg/kg - DW)	Calculated
BaBeef	Beef biotransfer factor (day/kg - WW)	See Appendix E
F_forage	Fraction of forage grown on contaminated soil and eaten (unitless)	See Appendix F
F_grain	Fraction of grain grown on contaminated soil and eaten (unitless)	See Appendix F
F_silage	Fraction of silage grown on contaminated soil and eaten (unitless)	See Appendix F
Qfbs	Quantity of forage eaten each day by beef cattle (kg - DW/day)	See Appendix F
Qgbs	Quantity of grain eaten each day by beef cattle (kg - DW/day)	See Appendix F
Qsbs	Quantity of silage eaten each day by beef cattle (kg - DW/day)	See Appendix F
Qsoilbs	Consumption rate of soil for beef cattle (kg/day)	See Appendix F
Qwbs	Consumption rate of water by subsistence beef cattle (L/d)	See Appendix F
Csoil	Concentration of contaminant in soil (mg/kg)	Set equal to waste concentration

C _{water}	Total concentration in the water (mg/L)	Set equal to waste concentration
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Source: U.S. EPA, 2000.

Table D-14. Concentration in Fish (mg/kg)

$$C_{fish}$$

$$C_{fish} = C_{dw} \times BCF_{fish}$$

Name	Description	Value
BCF _{fish}	Bioconcentration factor (mg/kg)/(mg/L)	See Appendix E
C _{dw}	Concentration in water (dissolved) (mg/L)	Set equal to waste concentration

Source: U.S. EPA, 1998.

Table D-15. Daily Intake of Contaminant from Consumption of Above-Ground Produce (mg/kg BW/d)

<i>I_{ag}</i>

$$I_{ag} = I_{exfruit} + I_{exveg} + I_{profruit}$$

$$I = CR \times \frac{F}{1000} \times P \times (1 - L)$$

Name	Description	Value
1000	Conversion factor (g/kg)	
I _{exfruit}	Contaminant intake from consumption of exposed fruit (mg/kg BW/d)	Calculated
I _{exveg}	Contaminant intake from consumption of exposed vegetables (mg/kg BW/d)	Calculated
I _{profruit}	Contaminant intake from consumption of protected fruit (mg/kg BW/d)	Calculated
Pr _{exfruit}	Exposed fruit concentration (mg/kg)	Calculated
Pr _{exveg}	Exposed vegetable concentration (mg/kg)	Calculated
Pr _{profruit}	Protected fruit concentration (mg/kg)	Calculated
CR _{exfruit}	Daily human consumption rate of exposed fruit (g WW/kg BW/day)	See Appendix G
CR _{exveg}	Daily human consumption rate of exposed vegetables (g WW/kg BW/day)	See Appendix G
CR _{profruit}	Daily human consumption rate of protected fruit (g WW/kg BW/day)	See Appendix G
F _{exfruit}	Fraction of exposed fruit grown in contaminated soil (unitless)	See Appendix G

F_exveg	Fraction of exposed vegetables grown in contaminated soil (unitless)	See Appendix G
F_profruit	Fraction of protected fruit grown in contaminated soil (unitless)	See Appendix G
L_exfruit	Food preparation loss for exposed fruit (unitless)	See Appendix G
L_exveg	Food preparation loss for exposed vegetables (unitless)	See Appendix G
L_profruit	Food preparation loss for protected fruit (unitless)	See Appendix G

Source: U.S. EPA, 1998.

Table D-16. Daily Intake of Contaminant from Consumption of Below-Ground Produce (mg/kg-d)

<i>I_{bg}</i>

$$I_{bg} = Pr_{bg} \times \frac{CR_{bg}}{1000} \times F_{bg} \times (1 - L_{bg})$$

Name	Description	Value
1000	Conversion factor (g/kg)	
Pr _{bg}	Below ground vegetable concentration in whole weight (mg/kg WW)	Calculated
CR _{bg}	Daily human consumption rate of below ground vegetables (g WW/kg BW/day)	See Appendix G
F _{bg}	Fraction of below ground vegetables grown in contaminated soil (unitless)	See Appendix G
L _{bg}	Food preparation loss for root vegetables (unitless)	See Appendix G

Source: U.S. EPA, 1998.

Table D-17. Daily Intake of Contaminant from Consumption of Fish (mg/kg-d)

I_{fish}

$$I_{fish} = C_{fish} \times CR_{fish} \times \frac{F_{fish}}{(1000 \times BW)}$$

Name	Description	Value
1000	Conversion factor (g/kg)	
C _{fish}	Concentration of contaminant in fish (mg/kg)	Calculated
BW	Body weight (kg)	See Appendix G
CR _{fish}	Consumption rate of fish (g WW/day)	See Appendix G
F _{fish}	Fraction of fish intake from contaminated source (unitless)	See Appendix G

Source: U.S. EPA, 1998.

Table D-18. Daily Intake of Contaminant from Incidental Ingestion of Soil
(mg/kg-d)

<i>I_{soil}</i>		
$I_{soil} = \left(\frac{C_{soil} \times CRs \times F_{soil}}{BW} \right) \times 0.000001$		
Name	Description	Value
0.000001	Conversion factor (kg/mg)	
Isoil	Daily intake of contaminant from incidental ingestion of soil (mg/kg BW/d)	Calculated
BW	Body weight (kg)	See Appendix G
CRs	Soil ingestion rate (mg/day)	See Appendix G
F_soil	Fraction of contaminated soil that is ingested (unitless)	See Appendix G
Csoil	Concentration of contaminant in soil (mg/kg)	Set equal to waste concentration

Source: U.S. EPA, 1998.

Table D-19. Daily Intake of Contaminant from Ingestion of *i*th Animal Tissue Group (mg/kg BW/d)

<i>I_{animal}</i>

$$I_{beef} = A_{beef} \times \left(\frac{CR_{beef}}{1000} \right) \times F_{beef} \times L_{beef}$$

Name	Description	Value
1000	Conversion factor (g/kg)	
A _i	Concentration of contaminant in <i>i</i> th animal tissue group (mg/kg WW)	Calculated
CR _i	Daily human consumption rate of <i>i</i> th animal tissue group (g WW/kg BW/day)	See Appendix G
F _i	Fraction of animal tissue that is contaminated (unitless)	See Appendix G
L _i	Contaminant loss factor (unitless)	See Appendix G

Source: U.S. EPA, 1998.

Table D-20. Cancer Risk and Hazard Quotient Due to Inhalation (unitless)

<i>Risk_{Air}</i>

$$Risk_{Air} = \frac{(C_{vapor} \times BRi \times EDi \times EFi \times CSFInhal)}{(AT \times 365 \times BW)}$$

$$HQ_{Air} = \frac{C_{vapor}}{RFC}$$

Name	Description	Value
365	Conversion factor (days/yr)	
Cvapor	Vapor concentration of contaminant in air (mg/m ³)	Calculated
CSFInhal	Inhalation cancer slope factor (mg/kg/d)-1	See Appendix E
RfC	Noncancer reference concentration (mg/m ³)	See Appendix E
AT	Averaging time (yr)	See Appendix G
Bri	Breathing rate (m ³ /d)	See Appendix G
BW	Body weight (kg)	See Appendix G
EDi	Exposure duration for inhalation (yr)	See Appendix G
EFi	Exposure frequency (d/yr)	See Appendix G

Table D-21. Cancer Risk and Hazard Quotient Due to Ingestion (unitless)

<i>Risk_Oral</i>

$$Risk_Oral = \frac{(I \times ED \times EF \times CSF_{Oral})}{(AT \times 365)}$$

$$HQ_Oral = \frac{I}{RfD}$$

Name	Description	Value
365	Conversion factor (days/yr)	
I	Combined intake rate from soil, animal products and produce (mg/kg/d)	Calculated
CSF _{Oral}	Oral cancer slope factor (mg/kg/d)-1	See Appendix E
RfD	Noncancer reference dose (mg/kg/d)	See Appendix E
AT	Averaging time (yr)	See Appendix G
ED	Exposure duration for oral ingestion (yr)	See Appendix G
EF	Exposure frequency (d/yr)	See Appendix G

Appendix E

Chemical-Specific Inputs

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Table E-1. Chemical-Specific Inputs for Benzene (71432)

Parameter	Value	Units	Reference
BaBeef	3.39E-06	(mg/kg beef)/(mg/kg DW feed)	Travis and Arms, 1988.
BCF_fish	8.712	(mg/kg)/(mg/L)	BcfWIN v2.14
BrExfruit	2.27E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrExveg	2.27E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrForage	2.27E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrGrain	2.27E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrProfruit	2.27E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrSilage	2.27E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
CSFinhal	0.027	(per mg/kg-d)	calc IRIS
CSFOral	5.5E-02	(per mg/kg-d)	IRIS
Da	8.95E-02	cm ² /s	Calculated based on WATER9, 2001.
Density	0.8765	g/mL	SCDM
Dw	1.03E-05	cm ² /s	Calculated based on WATER9, 2001.
Fv	1	unitless	Junge and Bidleman
Fw	0.6	unitless	U.S. EPA, Parameter Guidance Document, 1997.
HLC	0.00555	atm-m ³ /m	SCDM
Koc	63.10	mL/g	Kolliq, 1993
KpPar	18.07	1/yr	U.S. EPA, Parameter Guidance Document, 1997.
KpVap	119.35	1/yr	U.S. EPA, Parameter Guidance Document, 1997.
LogKow	2.13	dimensionless	SCDM
MW	78.11	g/mole	SCDM
RCF	1.32E+00	(mg/kg WW plant)/(mg/L soil water)	Briggs et al., 1982
Sol	1750	mg/L	SCDM
Vdv	1	cm/s	U.S. EPA, Parameter Guidance Document, 1997.
VP	95	Torr	SCDM

Table E-2. Chemical-Specific Inputs for Trichloroethane, 1,1,2- (79005)

Parameter	Value	Units	Reference
BaBeef	2.82E-06	(mg/kg beef)/(mg/kg DW feed)	Travis and Arms, 1988.
BCF_fish	7.56	(mg/kg)/(mg/L)	BcfWIN v2.14
BrExfruit	2.53E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrExveg	2.53E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrForage	2.53E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrGrain	2.53E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrProfruit	2.53E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrSilage	2.53E+00	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
CSFinhal	0.056	(per mg/kg-d)	calc IRIS
CSFOral	5.7E-02	(per mg/kg-d)	IRIS
Da	6.69E-02	cm ² /s	Calculated based on WATER9, 2001.
Density	1.4397	g/mL	SCDM
Dw	1.00E-05	cm ² /s	Calculated based on WATER9, 2001.
Fv	1	unitless	Junge and Bidleman
Fw	0.6	unitless	U.S. EPA, Parameter Guidance Document, 1997.
HLC	0.000913	atm-m ³ /m	SCDM
Koc	53.7	mL/g	Kolliq
KpPar	18.07	1/yr	U.S. EPA, Parameter Guidance Document, 1997.
KpVap	119.35	1/yr	U.S. EPA, Parameter Guidance Document, 1997.
LogKow	2.05	dimensionless	SCDM
MW	133.4	g/mole	SCDM
RCF	1.14E+00	(mg/kg WW plant)/(mg/L soil water)	Briggs et al., 1982
Sol	4420	mg/L	SCDM
Vdv	1	cm/s	U.S. EPA, Parameter Guidance Document, 1997.
VP	23.25	Torr	SCDM

Table E-3. Chemical-Specific Inputs for Ethoxyethanol 2- (110805)

Parameter	Value	Units	Reference
BCF_fish	3.162	(mg/kg)/(mg/L)	BcfWIN v2.14
BrExfruit	4.42E+01	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrExveg	4.42E+01	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrForage	4.42E+01	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrGrain	4.42E+01	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrProfruit	4.42E+01	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
BrSilage	4.42E+01	(mg/kg DW plant)/(mg/kg DW soil)	Travis and Arms, 1988.
Da	8.19E-02	cm ² /s	Calculated based on WATER9, 2001.
Density	0.9297	g/mL	SCDM
Dw	9.76E-06	cm ² /s	Calculated based on WATER9, 2001.
Fv	1	unitless	Junge and Bidleman
Fw	0.6	unitless	U.S. EPA, Parameter Guidance Document, 1997.
HLC	1.23E-07	atm-m ³ /m	SCDM
Koc	21.02	mL/g	Calculated eq 4-8 chemical handbook
KpPar	18.07	(1/yr)	U.S. EPA, Parameter Guidance Document, 1997.
KpVap	119.35	(1/yr)	U.S. EPA, Parameter Guidance Document, 1997.
LogKow	-0.1	dimensionless	SCDM
MW	90.12	g/mole	SCDM
RCF	8.45E-01	(mg/kg WW plant)/(mg/L soil water)	Briggs et al., 1982
RfC	0.2	mg/m ³	IRIS
RfD	4.0E-01	mg/kg-d	HEAST
Sol	1000000	mg/L	SCDM
Vdv	1	cm/s	U.S. EPA, Parameter Guidance Document, 1997.
VP	5.31	Torr	SCDM

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Appendix F

Model Parameters for Biota Data

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Table F-1. Model Parameters for Biota Data

Code	Description	Value	Reference
Cattle Intake Rates			
Qfbs	Quantity of forage eaten each day by beef cattle (kg - DW/day)	8.8	U.S.EPA, 1997.
Qfds	Quantity of forage eaten each day by dairy cattle (kg - DW/day)	11	U.S.EPA, 1997.
Qgbs	Quantity of grain eaten each day by beef cattle (kg - DW/day)	0.47	U.S.EPA, 1997.
Qgds	Quantity of grain eaten each day by dairy cattle (kg - DW/day)	2.6	U.S.EPA, 1997.
Qsbs	Quantity of silage eaten each day by beef cattle (kg - DW/day)	2.5	U.S.EPA, 1997.
Qsds	Quantity of silage eaten each day by dairy cattle (kg - DW/day)	3.3	U.S.EPA, 1997.
Qsoilbs	Consumption rate of soil for beef cattle (kg/day)	0.39	U.S.EPA, 1997.
Qsoilds	Consumption rate of soil for dairy cattle (kg/day)	0.41	U.S.EPA, 1997.
Qwbs	Consumption rate of water by subsistence beef cattle (L/day)	2.5	U.S.EPA, 1997.
Fraction Contaminated			
F_forage	Fraction of forage grown on contaminated soil and eaten (unitless)	1	U.S.EPA, 1997.
F_grain	Fraction of grain grown on contaminated soil and eaten (unitless)	1	U.S.EPA, 1997.
F_silage	Fraction of silage grown on contaminated soil and eaten (unitless)	1	U.S.EPA, 1997.
Vegetation			
Rp_exfruit	Interception fraction for exposed fruit (unitless)	0.052	U.S.EPA, 1997.
Rp_exveg	Interception fraction for exposed vegetables (unitless)	0.052	U.S.EPA, 1997.
Rp_forage	Interception fraction for forage (unitless)	0.47	U.S.EPA, 1997.
Rp_silage	Interception fraction for silage (unitless)	0.44	U.S.EPA, 1997.
Tp_exfruit	Length of plant exposure to deposition for exposed fruit (yr)	0.123	U.S.EPA, 1997.
Tp_exveg	Length of plant exposure to deposition for exposed vegetables (yr)	0.123	U.S.EPA, 1997.
Tp_forage	Length of plant exposure to deposition for forage (yr)	0.123	U.S.EPA, 1997.
Tp_silage	Length of plant exposure to deposition for silage (yr)	0.164	U.S.EPA, 1997.
VG_bg	Empirical correction factor for below ground vegetables (unitless)	0.01	U.S.EPA, 1997.
Yp_exfruit	Crop yield for exposed fruit (kg DW/m ²)	0.09	U.S.EPA, 1997.
Yp_exveg	Crop yield for exposed vegetables (kg DW/m ²)	0.18	U.S.EPA, 1997.
Yp_forage	Crop yield for forage (kg DW/m ²)	0.31	U.S.EPA, 1997.
Yp_silage	Crop yield for silage (kg DW/m ²)	0.31	U.S.EPA, 1997.

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Appendix G

Exposure Data

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Table G-1a. Model Parameters for Exposure Data

Code	Description	Value	Reference
AT	Averaging time (yr)	70	U.S. EPA, 1991.
Bri	Breathing rate (m ³ /d)	Receptor and Cohort Specific	See Table G-1b
BW	Body weight (kg)	Receptor and Cohort Specific	See Table G-1b
CR_beef	Daily human consumption rate of beef (g WW/kg BW/day)	Receptor and Cohort Specific	See Table G-1b
CR_bg	Daily human consumption rate of below ground vegetables (g WW/kg BW/day)	Receptor and Cohort Specific	See Table G-1b
CR_dw	Consumption rate of water (L/day)	Receptor and Cohort Specific	See Table G-1b
CR_exfruit	Daily human consumption rate of exposed fruit (g WW/kg BW/day)	Receptor and Cohort Specific	See Table G-1b
CR_exveg	Daily human consumption rate of exposed vegetables (g WW/kg BW/day)	Receptor and Cohort Specific	See Table G-1b
CR_fish	Consumption rate of fish (g WW/day)	Receptor and Cohort Specific	See Table G-1b
CR_milk	Daily human consumption rate of milk (g WW/kg BW/day)	Receptor and Cohort Specific	See Table G-1b
CR_profruit	Daily human consumption rate of protected fruit (g WW/kg BW/day)	Receptor and Cohort Specific	See Table G-1b
CRs	Soil ingestion rate (mg/day)	Receptor and Cohort Specific	See Table G-1b
ED	Exposure duration for oral ingestion (yr)	Receptor and Cohort Specific	See Table G-1b
EF	Exposure frequency (d/yr)	350	U.S. EPA, 1991.
F_beef	Fraction of animal tissue that is contaminated (unitless)	Receptor Specific	See Table G-1b
F_bg	Fraction of below ground vegetables grown in contaminated soil (unitless)	Receptor Specific	See Table G-1b
F_dw	Fraction of drinking water ingested that is contaminated (unitless)	1	
F_exfruit	Fraction of exposed fruit grown in contaminated soil (unitless)	Receptor Specific	See Table G-1b
F_exveg	Fraction of exposed vegetables grown in contaminated soil (unitless)	Receptor Specific	See Table G-1b
F_fish	Fraction of fish intake from contaminated source (unitless)	1	
F_milk	Fraction of milk that is contaminated (unitless)	Receptor Specific	See Table G-1b
F_profruit	Fraction of protected fruit grown in contaminated soil (unitless)	Receptor Specific	See Table G-1b
F_soil	Fraction of contaminated soil that is ingested (unitless)	1	
L_bg	Food preparation loss for root vegetables (unitless)	0.05	U.S. EPA, Exposure Factors Handbook, 1997.
L_exfruit	Food preparation loss for exposed fruit (unitless)	0.21	U.S. EPA, Exposure Factors Handbook, 1997.
L_exveg	Food preparation loss for exposed vegetables (unitless)	0.16	U.S. EPA, Exposure Factors Handbook, 1997.

Table G-1a. Model Parameters for Exposure Data

Code	Description	Value	Reference
L_profruit	Food preparation loss for protected fruit (unitless)	0.29	U.S. EPA, Exposure Factors Handbook, 1997.
L1_beef	Cooking loss for beef (unitless)	0.27	U.S. EPA, Exposure Factors Handbook, 1997.
L2_beef	Post-cooking loss for beef (unitless)	0.24	U.S. EPA, Exposure Factors Handbook, 1997.
SY	Start year (yr)	Receptor and Cohort Specific	See Table G-1b

Table G-1b. Exposure Data for Farmer/Fisher Receptor

Code	Value	Cohort_1	Cohort_2	Cohort_3	Cohort_4
F_exfruit (unitless)	0.328				
L2_beef (unitless)	0.24				
SY (yr)		3	8	15	20
Bri (m3/d)		7.6	11.8	14	13.3
BW (kg)		15.3	29.6	56.8	69.3
CR_beef (g WW/kg BW/day)		2.11	2.11	1.51	1.64
CR_exfruit (g WW/kg BW/day)		1.82	1.11	0.609	1.3
CR_exveg (g WW/kg BW/day)		1.46	0.643	0.656	1.38
CR_fish (g WW/day)		2	2	2	2
CR_milk (g WW/kg BW/day)		69.99	38.6	14.28	12.1
CR_profruit (g WW/kg BW/day)		2.34	2.34	1.23	2.13
CR_root (g WW/kg BW/day)		0.686	0.523	0.565	0.883
CRs (mg/day)		100	50	50	50
L1_beef (unitless)	0.27				
F_beef (unitless)	0.485				
F_soil (unitless)	1				
F_exveg (unitless)	0.42				
F_fish (unitless)	1				
F_milk (unitless)	0.254				
F_profruit (unitless)	0.03				
F_root (unitless)	0.173				
L_exfruit (unitless)	0.21				
L_exveg (unitless)	0.16				
L_profruit (unitless)	0.29				
L_root (unitless)	0.05				
CR_dw (L/day)		0.6165	0.731	0.8685	1.275
F_dw (unitless)	1				
EF (d/yr)	350				
ED (yr)		5	7.5	8	10

Ref: U.S. EPA, Exposure Factors Handbook, 1997.

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Appendix H

Model Parameters for Site Data

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Table H-1. Model Parameters for Site Data Data

Code	Description	Value	Reference
DF_A	Constant selected based on location (unitless)	13	SSL, U.S. EPA, 2001
DF_B	Constant selected based on location (unitless)	19	SSL, U.S. EPA, 2001
DF_C	Constant selected based on location (unitless)	215	SSL, U.S. EPA, 2001
foc_soil	Fraction organic carbon; top 20 cm of soil (fraction)	0.0686	
Meteorology			
May	Average annual moisture (precipitation: rainfall, snowfall) (cm/yr)	114	Based on Hartford, CT
T_air	Ambient temperature (K)	283	Based on Hartford, CT
Surface Soil			
BD	Dry soil bulk density (g/cm ³)	1.56	Value for sandy loam, Hartford
Theta_w	Soil volumetric water content OR water-filled soil porosity (L water/L soil)	0.15	SSL, U.S. EPA, 2001
Area	Source Area (acres)	0.5	SSL, U.S. EPA, 2001

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